

CLAIMS

1. A phosphor element comprising:
 - an electron hole injection electrode and an electron injection electrode disposed opposite to each other;
 - an electron hole transport layer, a phosphor layer, and an electron transport layer stacked in this order from the side of the electron hole injection electrode toward the side of the electron injection electrode, wherein the stacked layers are sandwiched between the electron hole injection electrode and the electron injection electrode, and wherein the phosphor layer includes an inorganic phosphor material in which at least one part of the surface is covered with an organic material.
2. The phosphor element according to claim 1, wherein the phosphor layer includes an inorganic phosphor layer in which at least one part of the surface is covered with an organic material.
3. The phosphor element according to claim 2, further comprising first and second substrates disposed opposite to each other in which at least one of them is transparent or semi-transparent,
 - wherein the electron hole injection electrode, the electron hole transport layer, the phosphor layer, the electron transport layer, and the electron injection electrode are sandwiched in this order between the first and second substrates.
4. The phosphor element according to claim 2 or 3, wherein the inorganic phosphor layer is a fluorescent substance including a semiconductor host

crystal.

5. The phosphor element according to claim 4, wherein the organic material is chemically adsorbed to at least one part of a surface of the inorganic phosphor layer.

6. The phosphor element according to claim 5, wherein the organic material is a conductive organic material having an electron hole transporting property and chemically adsorbed to the surface of the inorganic phosphor layer disposed opposite to the electron hole transport layer.

7. The phosphor element according to claim 5, wherein the organic material is a conductive organic material having an electron transporting property and chemically adsorbed to the surface of the inorganic phosphor layer disposed opposite to the electron transport layer.

8. The phosphor element according to claim 5, wherein the organic material includes a conductive organic material having an electron hole transporting property and a conductive organic material having an electron transporting property,

wherein the conductive organic material having the electron hole transporting property is chemically adsorbed to the surface of the inorganic phosphor layer disposed opposite to the electron hole transport layer,

wherein the conductive organic material having the electron transporting property is chemically adsorbed to the surface of the inorganic

phosphor layer disposed opposite to the electron transport layer.

9. The phosphor element according to claim 1, wherein the phosphor layer includes an inorganic phosphor particle in which at least one part of the surface is covered with an organic material.

10. The phosphor element according to claim 9, further comprising first and second substrates disposed opposite to each other in which at least one of them is transparent or semi-transparent,

wherein the electron hole injection electrode, the electron hole transport layer, the phosphor layer, the electron transport layer, and the electron injection electrode are sandwiched in this order between the first and second substrates.

11. The phosphor element according to claim 9 or 10, wherein the inorganic phosphor particle is a fluorescent substance including a semiconductor host crystal.

12. The phosphor element according to claim 11, wherein the organic material is provided on at least one part of the surface of the inorganic phosphor particle by chemical adsorption.

13. The phosphor element according to claim 12, wherein the organic material is a conductive organic material having an electron hole transporting property and an electron transporting property.

14. The phosphor element according to claim 12, wherein the organic material includes a conductive organic material having an electron hole transporting property and a conductive organic material having an electron transporting property.

15. The phosphor element according to claim 4 or 11, wherein the semiconductor host crystal includes an oxide or a composite oxide including at least one kind of element selected from a group of Zn, Ga, In, Sn and Ti.

16. The phosphor element according to any one of claims 1 to 15, further comprising an electron hole injection layer sandwiched between the electron hole injection electrode and the electron hole transport layer.

17. The phosphor element according to any one of claims 1 to 16, further comprising an electron injection layer sandwiched between the electron injection electrode and the electron transport layer.

18. The phosphor element according to any one of claims 1 to 17, further comprising an electron hole block layer sandwiched between the phosphor layer and the electron transport layer.

19. The phosphor element according to any one of claims 1 to 18, further comprising a thin film transistor connected to the electron hole injection electrode.

20. The phosphor element according to any one of claims 1 to 18, further comprising a thin film transistor connected to the electron injection electrode.

21. The phosphor element according to claim 19 or 20, wherein the thin film transistor is an organic thin film transistor including a thin film formed of an organic material.

22. A display device comprising:

a phosphor element array in which the plurality of phosphor elements according to any one of claims 19 to 21 are arranged two dimensionally;

a plurality of x electrodes extending parallel to each other in a first direction parallel to a surface of the phosphor element array; and

a plurality of y electrodes extending parallel to each other in a second direction which is parallel to a surface of the phosphor element array and perpendicular to the first direction,

wherein the thin film transistor of the phosphor element array is connected to the x electrode and the y electrode.